ERKNet
The European
Rare Kidney Disease
Reference Network

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PREGNANCY AND THE KIDNEY

“ Children of women with renal disease used to be born dangerously or not at all - not at all if their doctors had their way…

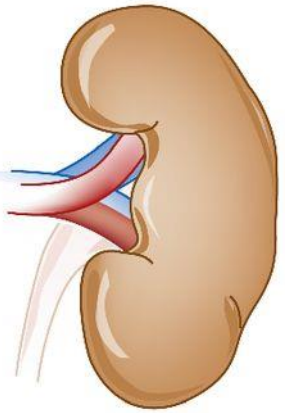
“ Nature takes a helping hand by blunting fertility as renal function falls”

Lancet, 1975,801-802

OUTLINE

1. Physiological changes in pregnancy
2. Counselling in pregnancy
    1. Underlying disease
    2. Impact of renal function on pregnancy outcome
    3. Impact of pregnancy on renal outcome
    4. The case
3. Special situations
    1. Dialysis
    2. Transplantation
    3. AKI in pregnancy
    4. Drug therapy in pregnancy

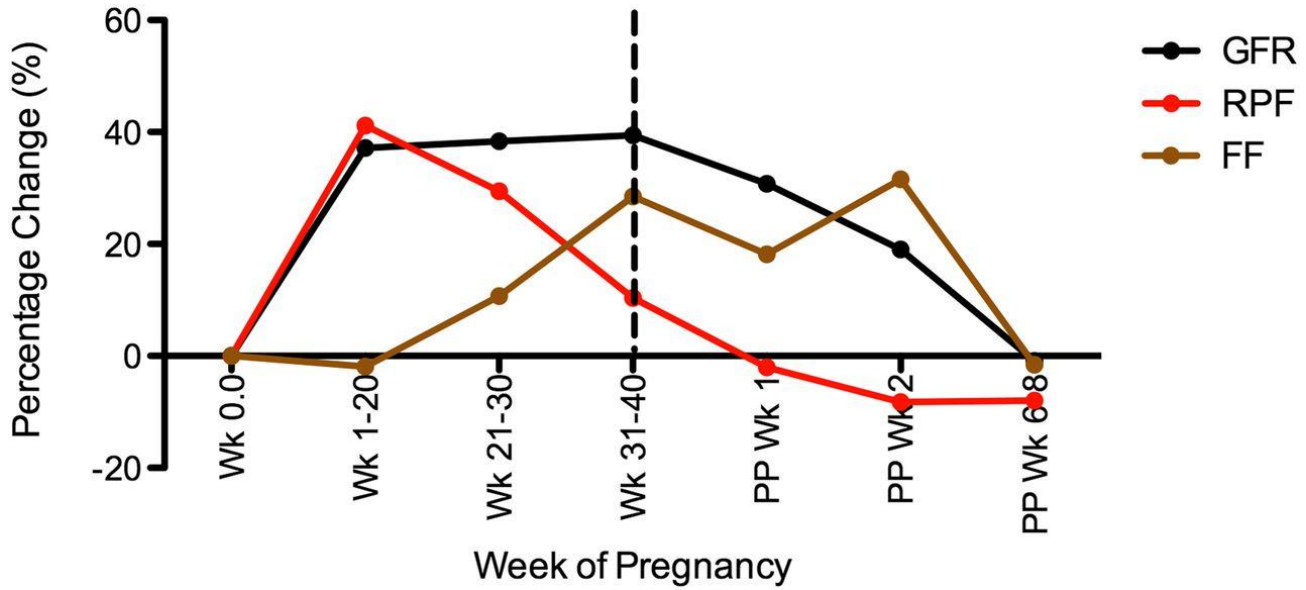
ANATOMICAL
- Increase in kidney size (1 cm)
- Dilation of the collecting system (R>L)



GLOMERULAR HEMODYNAMICS
- Vasodilatation
- Increase in RPF and GFR

TUBULAR FUNCTION
- Altered tubular reabsorption of protein, glucose, amino acids and uric acid

ELECTROLYTE BALANCE
- Increased total body sodium up to 900–1,000 meq
- Increased total body potassium up to 320 meq
- Decrease in set point for thirst and ADH release
- Expansion of plasma volume



Odutayo and Hladunawich CJASN 2012;7:2073-2080

THE CASE

A 24-year patient comes to your outpatient clinic for the first time. She has a history of hypertension and vesico-ureteral reflux and “some renal insufficiency”

R/ metoprolol

Current lab tests:

Serum creatinine of 1,7 mg/dl/ eGFR of 39 ml/min/1.73m^2 (CKD stage III)

Proteinuria: 1,2 g/g

Blood pressure:

145/85 mm Hg office blood pressure

How are we going to counsel?

PERSPECTIVES ON PREGNANCY IN WOMEN WITH CKD

Systemic review of qualitative studies:
(15 studies, n= 257)

- 7 Major themes:
  - Pursuing motherhood
  - Failure to fulfill social norms
  - Fear of birth defects (ie IS) and transmitting genetic disease
  - Decisional insecurity and conflict
    - Fear of graft loss
    - Future??
  - Witholding emotional investments
  - Control and determination
  - Exacerbating disease

Tong A et al, NDT 2015; 652-660

General rules - COUNSELLING: PATIENT TAILORED

TABLE I
WOMEN WITH RENAL DISEASE WHO SHOULD BE REFERRED FOR PRE-PREGNANCY COUNSELING

- Women with CKD stage 1-2 and adverse risk factors:
  - ➢ Significant proteinuria
  - ➢ Hypertension
  - ➢ Systemic diseases such as lupus or vasculitis
  - ➢ Previous adverse obstetric history
- Women with CKD stage 3 to 5 including women on dialysis
- Women with renal transplants
- Women with a family history of hereditary renal disease

CKD = chronic kidney disease.

MULTIDISCIPLINARY APPROACH

Lightstone L J nephrol 2012

MOST COMMON UNDERLYING DISEASE - TIMING

SLE

Minimal changes/focal sclerosis

IgA nephropathy

Membranous

Vasculitis

Diabetic nephropathy T1 and T2

CAKUT

Hereditary nephropathy (Alport/ADPKD)

- Specific risks eg Alport: nephrotic syndrome

Timing of conception

- Diabetes: adequately controlled blood pressure and glucose
- Lupus nephritis: 6 m quiescent disease
- GN: stabilizing disease activity mm Hg)
- Blood pressure well controlled and switch to non teratogenic treatment (<140/90 mmHg) (target in pregnancy: 135/85 mm Hg)

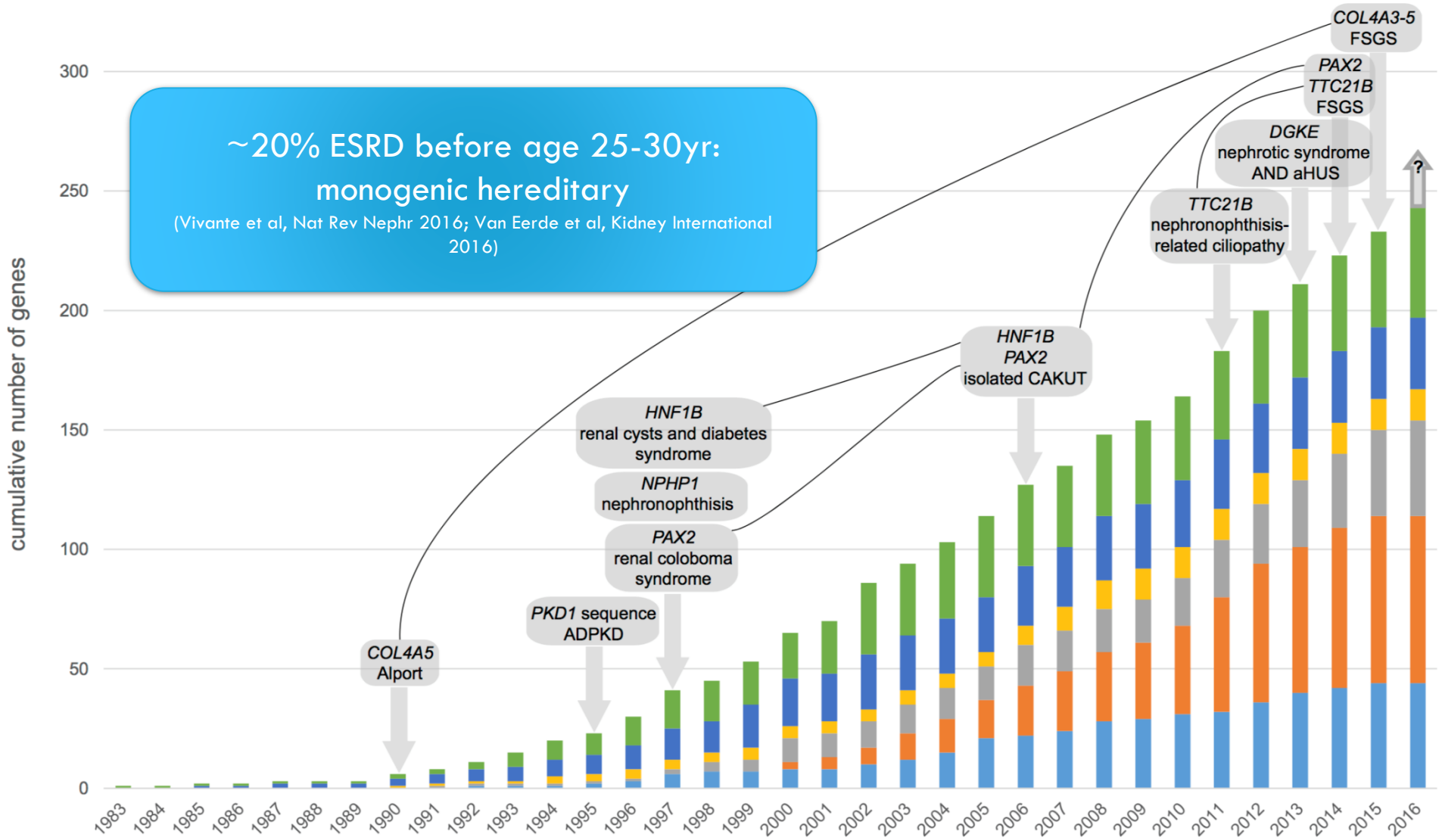
GENETIC COUNSELLING

-25% of patients with CKD ➔ family history

10%-20% of patients with CKD ➔ mendelian causes

10% of patients with CKD ➔ “others” or “unknown”

INCREASE IN AWARENESS IS NECESSARY ➔ INCREASE IN KNOWLEDGE

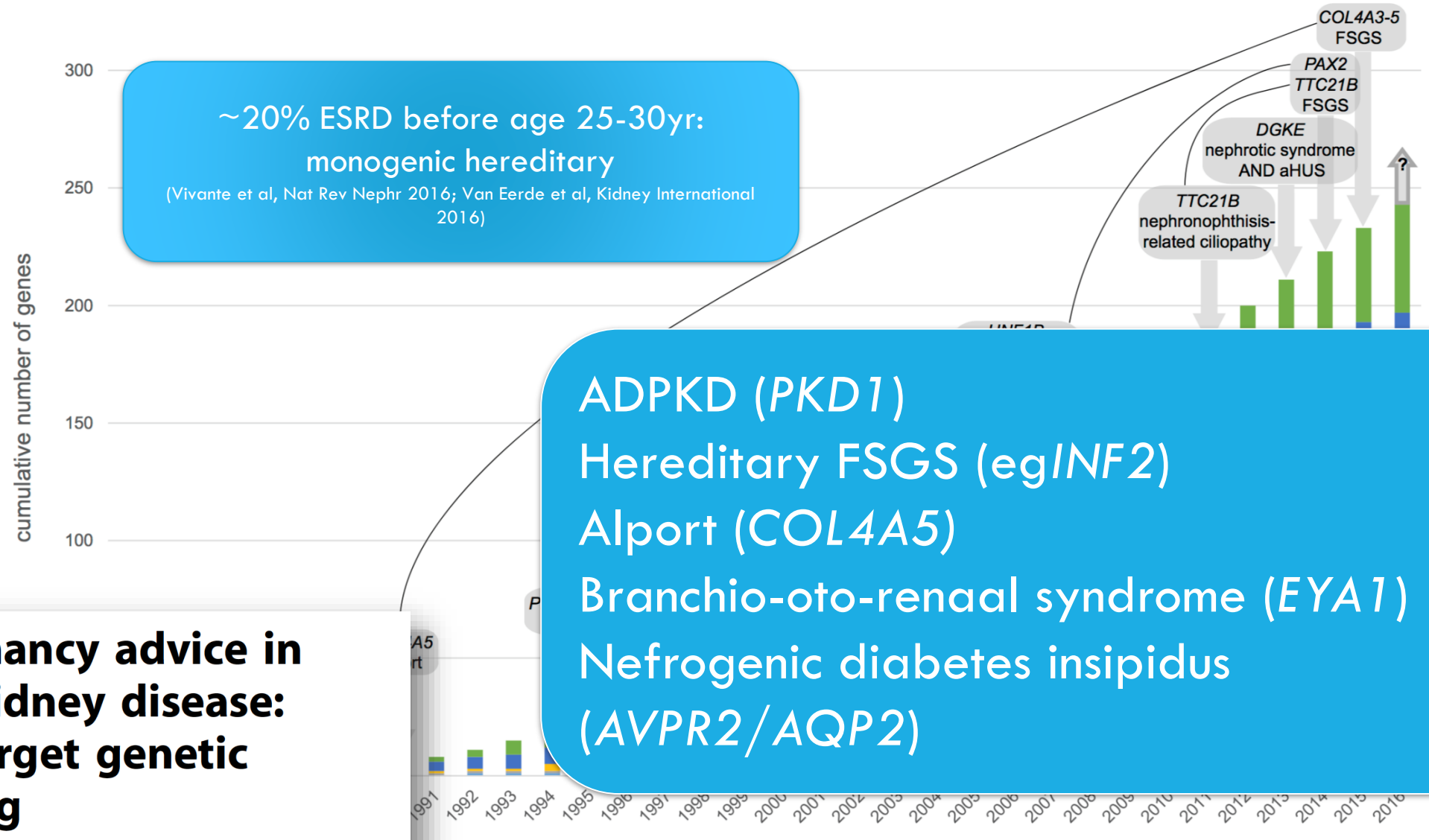


Van Eerde et al, Kidney International 2016

INCREASE IN AWARENESS IS NECESSARY ➔ INCREASE IN KNOWLEDGE

~20% ESRD before age 25-30yr: monogenic hereditary

(Vivante et al, Nat Rev Nephr 2016; Van Eerde et al, Kidney International 2016)



ADPKD (*PKD1*)
Hereditary FSGS (eg*INF2*)
Alport (*COL4A5*)
Branchio-oto-renaal syndrome (*EYA1*)
Nefrogenic diabetes insipidus (*AVPR2/AQP2*)

Pre-pregnancy advice in chronic kidney disease: do not forget genetic counseling

To the Editor: We applaud Hladunewich *et al.*[1]

Van Eerde et al, Kidney International 2016

6 OPTIONS FOR COUPLES CONFRONTED WITH AN INCREASED RISK OF A CHILD WITH A GENETIC DISEASE

conceive naturally, no tests

conceive naturally, prenatal diagnostic test, potentially followed by termination

sperm or oocyte donation

adoption

have no children

depends on:

- disease severity
- patient preference
- local availability

preimplantation genetic testing (PGT) / "embryoselection"

- identifying un-affected embryos
  - ex vivo / **before implantation**

- prevent genetic disease in following generations
  - without termination of pregnancy

PREIMPLANTATION GENETIC TESTING PROCEDURE

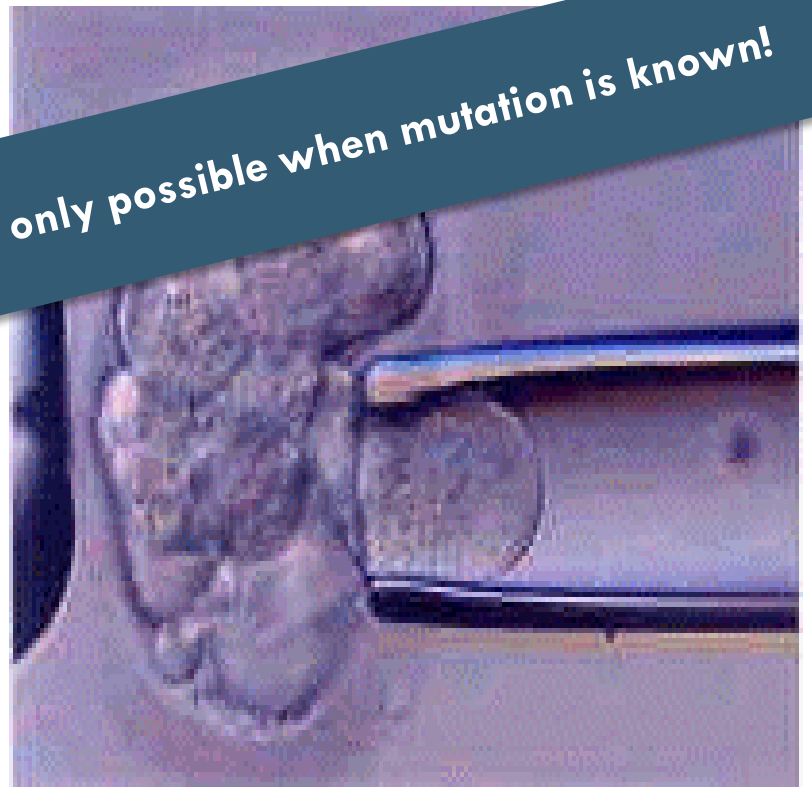
1. preparation time
2. hormone treatment, IVF / ICSI
3. **embryo biopsy**
4. genetic testing of **1 cell**
5. embryo transfer

invasive

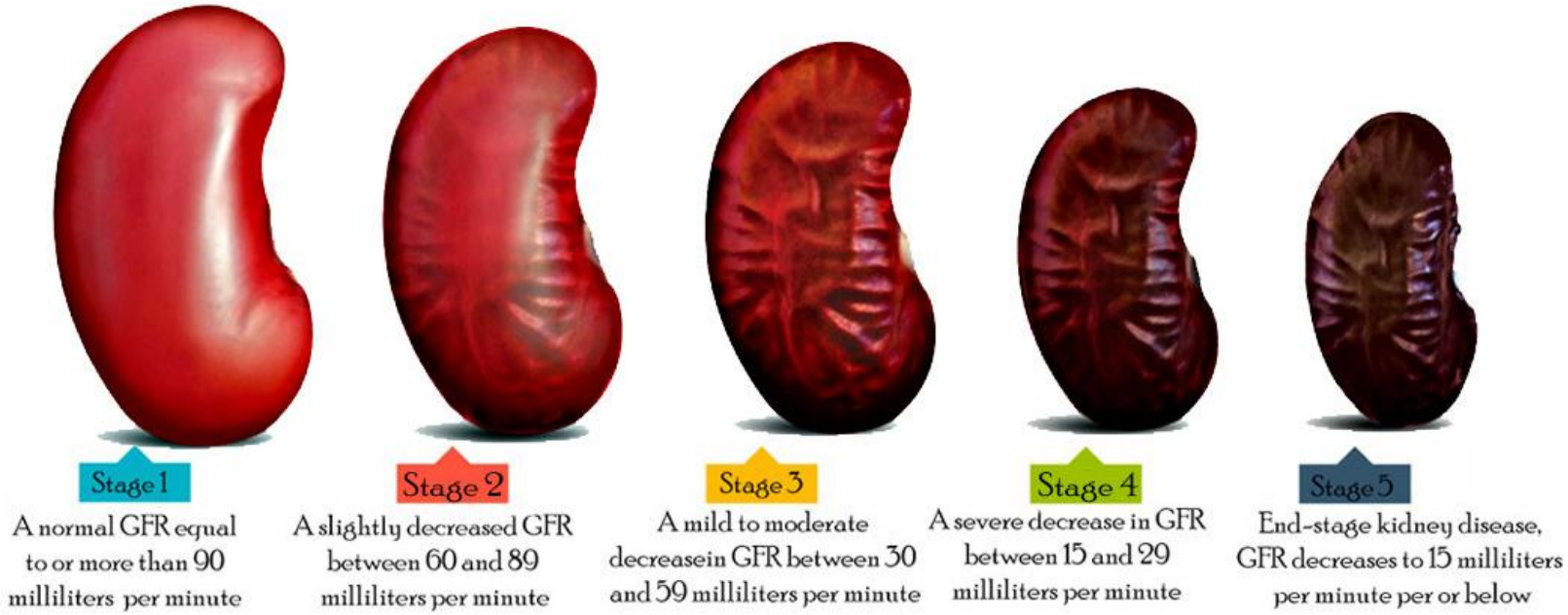
time consuming

success rate

Also genetic counselling for non mendelian causes eg CAKUT



IMPACT CKD ON PREGNANCY ?



Impact CKD on pregnancy

Maternal risk:

- hypertensive disorder of pregnancy (now onset or worsening; persistence after delivery)
- Mode of delivery: C-section and induction rate increase

Child risk:

- prematurity (with its sequelae)
- dysmaturity
- inheritance of maternal disease, malformations
- side effects of maternal drug therapy

Table 4. Comparisons across CKD stages

Characteristic	CKD Stage				*P* Value across Stages
	1 (*n*=370)	2 (*n*=87)	3 (*n*=37)	4–5 (*n*=10)	
Baseline data					
Maternal age (yr)	31.3±5.5	33.8±4.5	33.5±4.1	32.3±5.2	<0.001
Parity (% nulliparous)	54.6	57.5	64.9	70.0	0.50
Referral week	15.0 (4–39)	11.0 (4–38)	8.0 (5–33)	8.0 (4–28)	<0.001
Systemic disease (%)	11.6 (43/370)	35.6 (31/87)	43.2 (16/37)	40.0 (4/10)	<0.001
Hypertension (%)	21.6 (80/370)	41.4 (36/87)	54.1 (20/37)	20.0% (2/10)	<0.001
Proteinuria (g/d)					
Baseline	0.12 (0–14.6)	0.15 (0–6.8)	0.50 (0–2.8)	0.63 (0.10–3.44)	<0.001
<0.3	78.4 (286/370)	65.1 (56/86)	33.3 (12/36)	22.2 (2/9)	
≥0.3 to <0.5	7.9 (29/370)	5.8 (5/86)	11.1 (4/36)	11.1 (1/9)	
≥0.5 to <1.0	5.2 (19/370)	8.1 (7/86)	33.3 (12/36)	33.3 (3/9)	
≥1.0 to <3.0	6.0 (22/370)	14.0 (12/86)	22.2 (8/36)	22.2 (2/9)	
≥3.0	2.5 (9/370)	7.0 (6/86)	—	11.1 (1/9)	
Maternal-fetal outcomes					
Cesarean sections	48.4	70.1	78.4	70.0	<0.001
Gestational week	37.6±2.6	35.7±3.2	34.4±2.4	32.6±4.2	<0.001
Preterm delivery (<37 wk)	23.5	50.6	78.4	88.9	<0.001
Early preterm (<34 wk)	7.3	20.7	37.8	44.4	<0.001
Birth weight (g)	2966.5±659	2484±707	2226.3±582	1639±870	<0.001
SGA score (Parazzini)					
<10%	13.3	17.9	18.9	50.0	0.02
<5%	5.1	6.0	5.4	25.0	0.12
Need for NICU	10.3	27.6	44.4	70.0	<0.001
General combined outcome	34.1	63.2	83.8	90.0	<0.001
Severe combined outcome	21.4	44.8	59.5	80.0	<0.001
New-onset hypertension (%)	7.9 (23/290)	17.6 (9/51)	47.1 (8/17)	50.0 (4/8)	<0.001
New-onset or doubling of proteinuria	20.5 (76/370)	37.9 (33/87)	86.5 (32/37)	70.0 (7/10)	<0.001
CKD stage shift or RRT start	7.6 (28/370)	12.6 (1/87)	16.2 (6/37)	20.0 (2/10)	0.12

Picollo, J Am Soc Nephrol 26: 2011–2022, 2015

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IMPACT CKD ON PREGNANCY

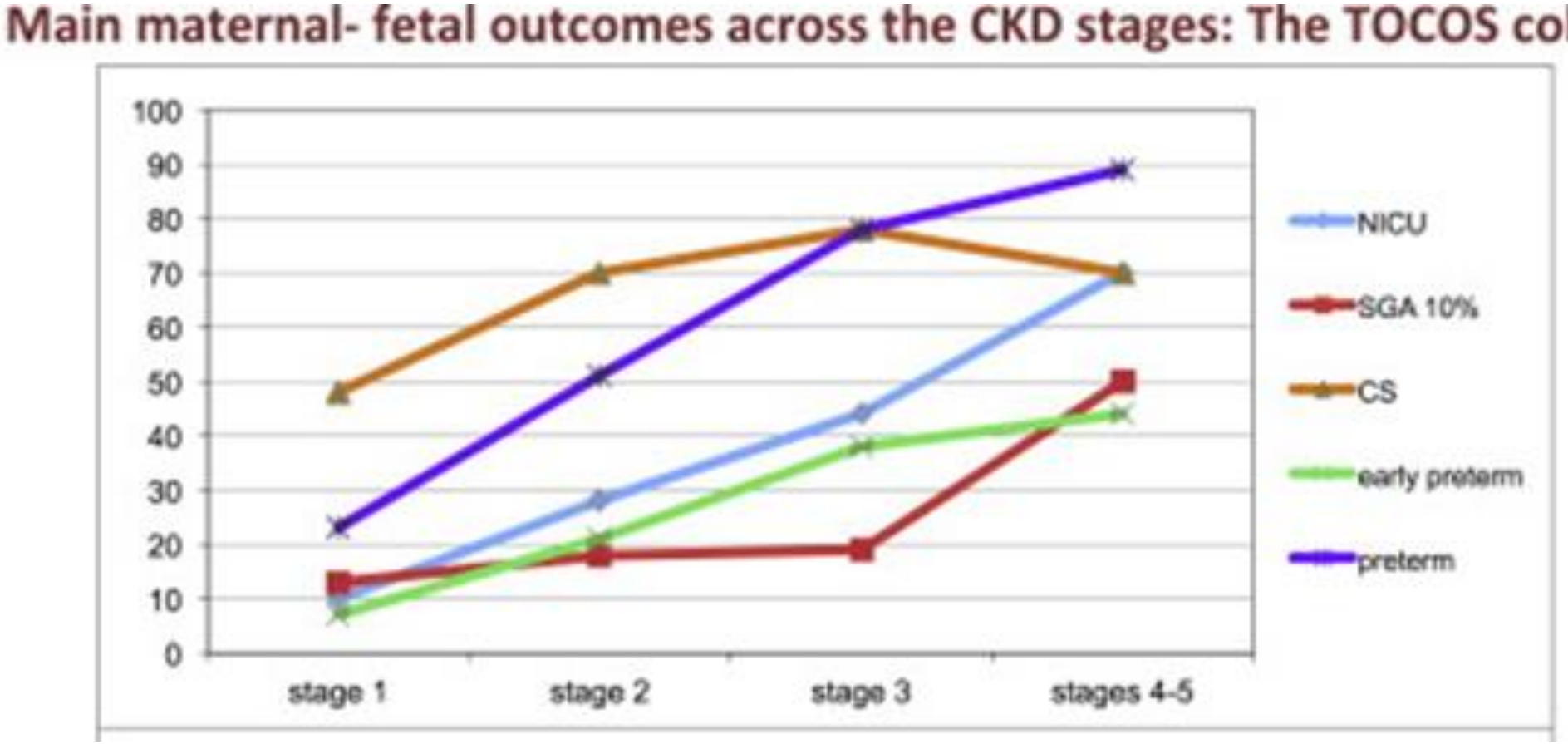
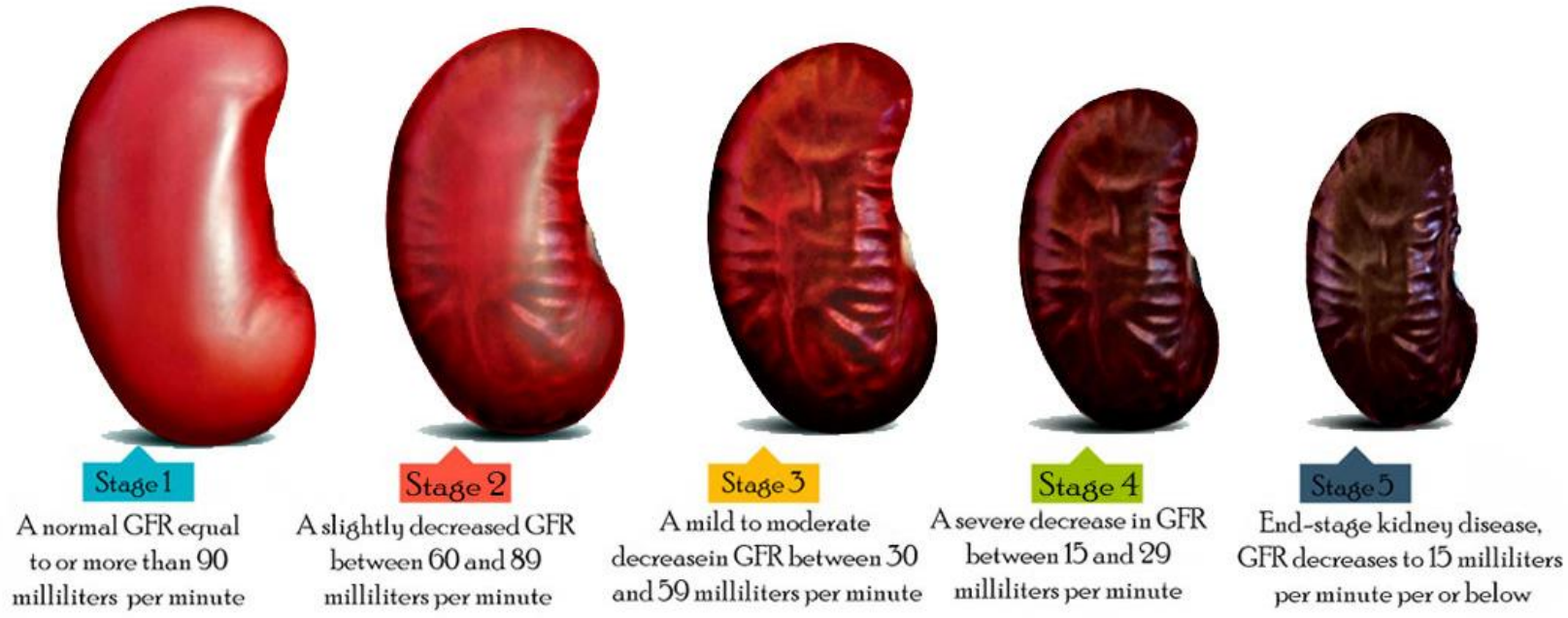


Fig. 2 Risk patterns in the various CKD stages in the ToCOS cohort (Torino *Cagliari* Observational Study), data collection on 504 live-born singleton deliveries in CKD patients followed up in the two largest facilities for CKD in pregnancy

Piccoli GB; Best Practice & Research Clinical Obstetrics & Gynaecology, 2015

IMPACT PREGNANCY ON CKD ?



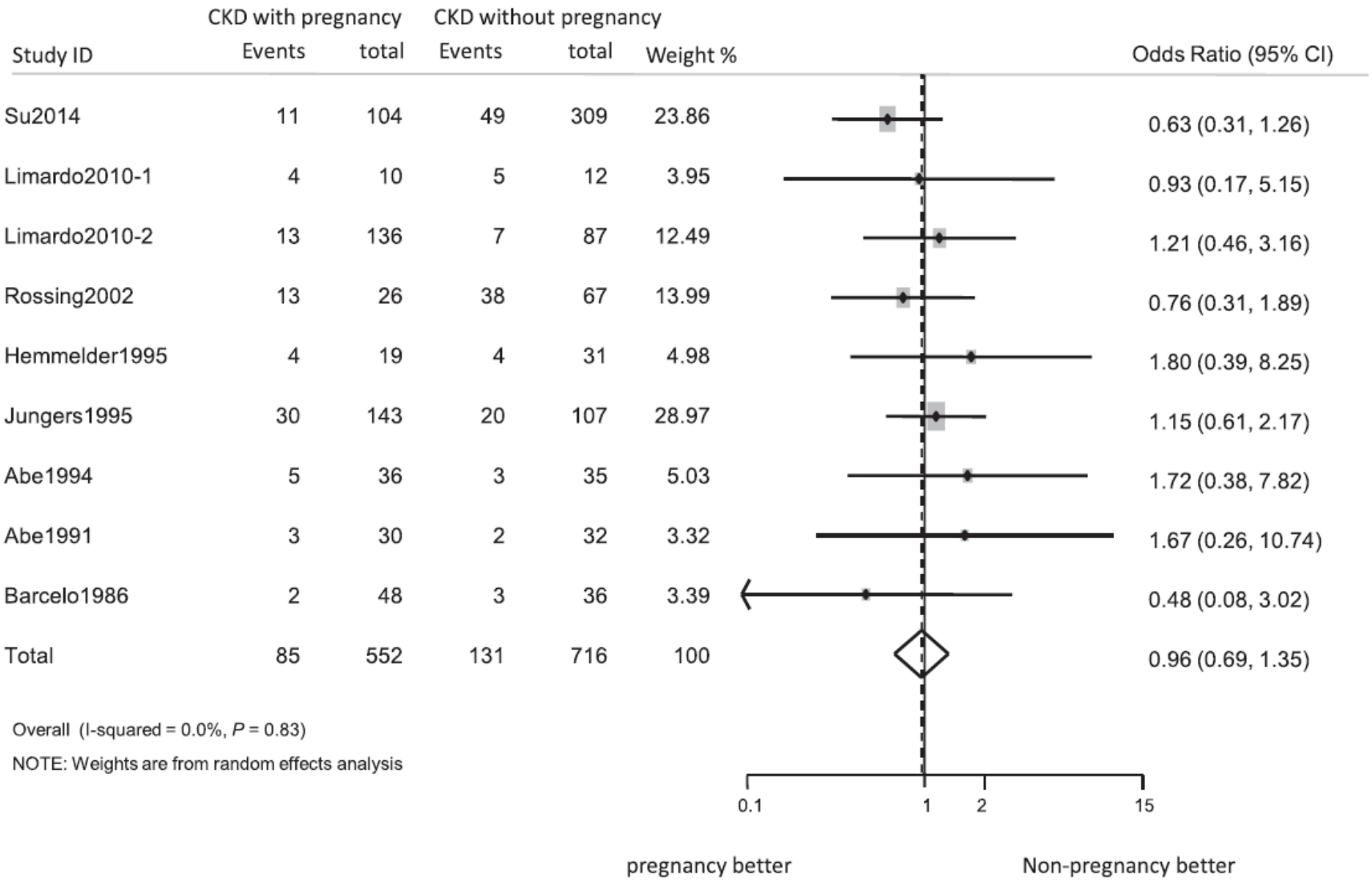
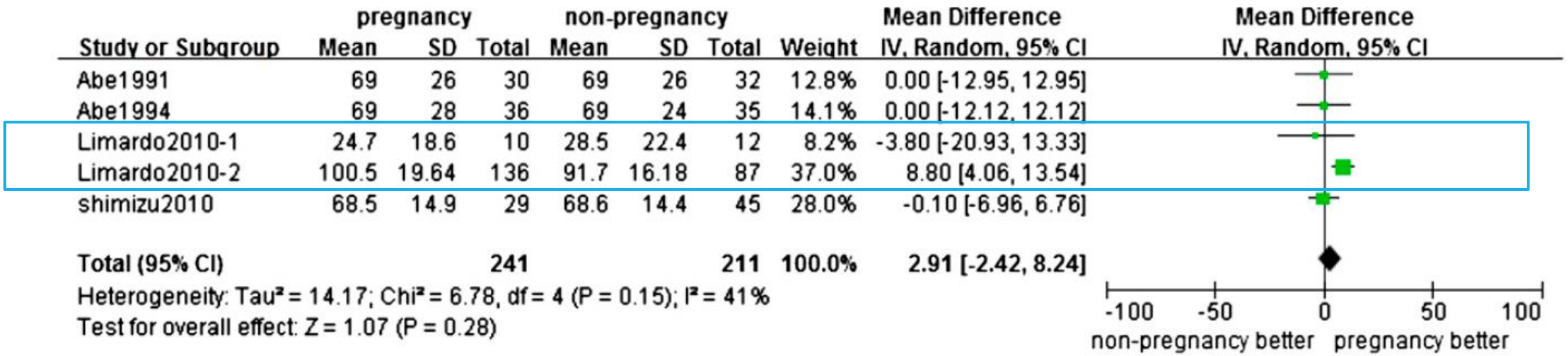


Figure 5. | **Overall odds ratios of the association of pregnancy and renal events** (including doubling of serum creatinine levels, 50% decrement of eGFR/CCr, and ESRD). 95% CI, 95% confidence interval; CCr, creatinine clearance rate.

Zhang, Clin J Am Soc Nephrol. 2015 Nov 6;10(11):1964-78

PREGNANT VERSUS NON PREGNANT



Study or Subgroup	pregnancy Mean	SD	Total	non-pregnancy Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
Abe1991	69	26	30	69	26	32	12.8%	0.00 [-12.95, 12.95]
Abe1994	69	28	36	69	24	35	14.1%	0.00 [-12.12, 12.12]
Limardo2010-1	24.7	18.6	10	28.5	22.4	12	8.2%	-3.80 [-20.93, 13.33]
Limardo2010-2	100.5	19.64	136	91.7	16.18	87	37.0%	8.80 [4.06, 13.54]
shimizu2010	68.5	14.9	29	68.6	14.4	45	28.0%	-0.10 [-6.96, 6.76]
Total (95% CI)			**241**			**211**	**100.0%**	**2.91 [-2.42, 8.24]**

Heterogeneity: Tau² = 14.17; Chi² = 6.78, df = 4 (P = 0.15); I² = 41%
Test for overall effect: Z = 1.07 (P = 0.28)

Figure 7. | Outcome of eGFR/CCr in women with CKD after pregnancy compared with non-pregnancy. 95% CI, 95% confidence interval; CCr, creatinine clearance rate. IV, method of analysis was inverse variance.

Zhang, Clin J Am Soc Nephrol. 2015 Nov 6;10(11):1964-78

Table 1. Prepregnancy kidney function in patients with CKD with estimates of problems in pregnancy (fetal growth restriction, preeclampsia, preterm delivery, and significant kidney function loss in pregnancy [>25% SCr increment]), obstetric outcome, and loss of kidney function: The effect of altering cut-off between moderate and severe dysfunction from 2.8 mg/dl (≥250 μmol/L) to 2.0 mg/dl (≥180 μmol/L), respectively

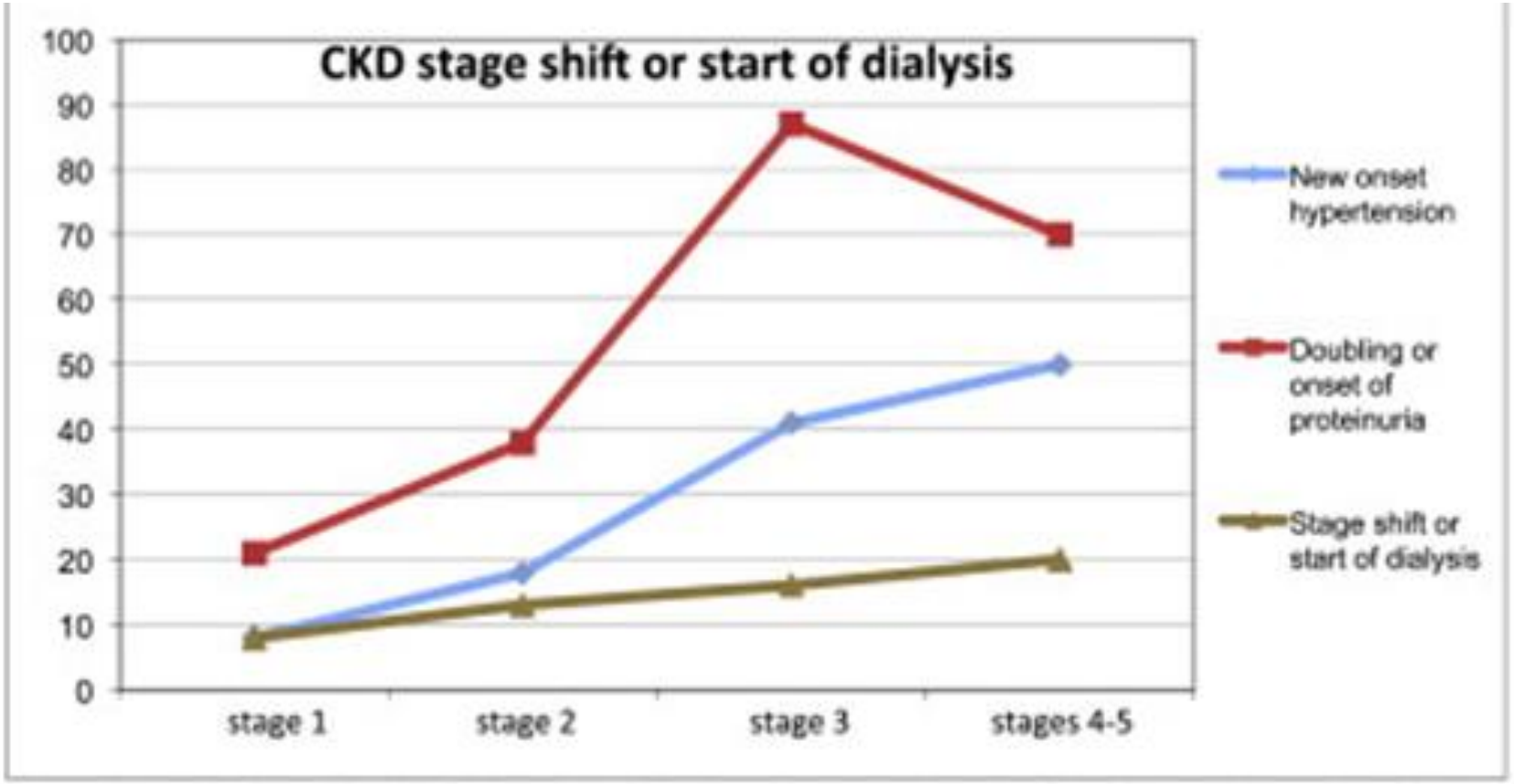
Renal Status (Dysfunction)	SCr, mg/dl	Problems in Pregnancy, %	Successful Obstetric Outcome, %	Compared with Prepregnancy, a Permanent PP Loss of Kidney Function (>25% Increment in SCr), %	ESRD within 1 yr PP, %
Mild	≤1.4 (≤125 μmol/L)	26	96	<2	—
Moderate	≥1.4 (≥125 μmol/L)	50	90	25	3
Severe	≥2.8 (≥250 μmol/L)	86	74	55	40
Mild	≤1.4 (≤125 μmol/L)	26	96	<2	—
Moderate	≥1.4 (≥125 μmol/L)	42	95	15	1
Severe	≥2.0 (≥180 μmol/L)	79	78	50	38

Estimates are on the basis of a 26-year literature review (1984–2010) of pregnancies that attained ≥24-weeks gestation. The aim is to provide at a glance information to facilitate prepregnancy counseling and management, while not belittling the much more detailed coverage and analyses (with their own inherent weaknesses too) in the publications used and others quoted in this article. PP, postpartum; ESRD, end stage renal disease; Table supplemented and modified from refs 13 and 16

Davison ,1985

	N	SCr mg/dL	Loss of kidney function
Jones, NEJM, 1996	59 15	1.4-2.4 (125-220 µmol/L) ≥ 2.4 (220 µmol/L)	43% / 10% (> 25% loss/ESRD by 6m postpartum)
Piccoli, JASN, 2015	37 10	CKD st 3 CKD st 4-5	16,2% (CKD stage shift or RRT start) 20% (CKD stage shift or RRT start)
Imbasciati, AJKD, 2007	22 27	eGFR 40-60 (mean 50 +/- 3) eGFR < 40 (mean 25.7 +/- 8)	30% (ESRD) and 10% (> 50% GFR loss) (FU 37mnd). RF: eGFR<40 & > 1 g proteinuria

IMPACT PREGNANCY ON CKD ?



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R/ metoprolol

Current lab tests:

Serum creatinine of 1,7 mg/dl/ eGFR of 39 ml/min/1.73m^2 (CKD stage III)

Proteinuria: 1,2 g/g

Blood pressure:

145/85 mm Hg office blood pressure

➔ **Three risk factors ➔ high risk**

General rules: CKD stages 1 and 2

Risk of pre-eclampsia (10%-20%)(5% normal)

Risk of preterm delivery (11%-40%)

Low birth weight (5-26%)

Risk increases with presence of:

- Proteinuria:
  - Nephrotic-range proteinuria: LMWH
- Hypertension:
  - Dd preeclampsia: difficult
  - FU of foetal growth to guide decision about delivery

Lightstone L J nephrol 2012

General rules: CKD stages 3 and 4

Fetal loss is greater

Preeclampsia: 40%-60%

Prematurity: 39%-64%

No creatinine reduction in the first trimester: suggestive of future complications

Predictors: <40 ml/min/1.73 m^2 and proteinuria >1 g/24h

Reduction in fertility

Lightstone L J nephrol 2012

PREGNANCY AND DIALYSIS

Pregnancy on dialysis is rare

Fertility loss

- 42% menstruation (59% irregular (anovulatory)) ➔ late diagnosis

Sexual dysfunction

- Anemia, depression, fatigue, side effects of antihypertensive treatment, change in body perception

Peritoneal dialysis: lower rate

- Peritonitis
- Lower implantation rate

BUN IS FOETOTOXIC

Fetal mortality related to serum levels of urea.

Intra-amniotic injection of urea ➔ therapeutic abortion

No successfull pregnancy if urea level >21,4 mmol/l (128 mg/dl)

McKay et al. Australian and NZ J of ObGyn 1963 / Greenhalf BMJ 1971

TORONTO (N=22) VERSUS USA (N=70) 2000-2013 – 1990-2011

Table 2. Cohort-specific pregnancy outcomes

Pregnancy Outcomes	Toronto PreKid Cohort	United States ARPD Cohort	*P* Value
Live birth rate (entire cohort)	19 (86.4)	43 (61.4)	0.03
Spontaneous abortion, first trimester	1 (4.5)	5 (7.1)	
Spontaneous abortion, second trimester	0 (0)	14 (20.0)	
Neonatal death	1 (4.5)	5 (7.1)	
Still birth	1 (4.5)	3 (4.3)	
Live birth rate (ESRD patients only)	15 (83.3)	30 (52.6)	0.02
Among patients with established ESRD			
Dialysis time (h/wk)	43±6	17±5	<0.001
Gestational age (wk)	36 (32–37)	27 (21–35)	0.002
Among patients with renal failure during pregnancy			
Dialysis time (h/wk)	33±6	15±4	<0.001
Gestational age (wk)	34 (29–37)	33 (31–37)	NS
All pregnancies (except first- and second-trimester spontaneous abortions			
Dialysis time (h/wk)	42±7	17±5	<0.001
Birth weight (g)	2118±857	1748±949	NS
Among surviving infants in established ESRD patients			
Normal birth weight	8 (50.0)	10 (32.3)	NS
Low birth weight (<2500 g)	7 (43.8)	12 (38.7)	
Very low birth weight (<1500 g)	1 (6.3)	9 (29.0)	

Values are presented as *n* (%), mean±SD, or median (interquartile range). Values for gestational age are rounded to the nearest week.

Hladunawich, JASN 2014

TORONTO VS USA

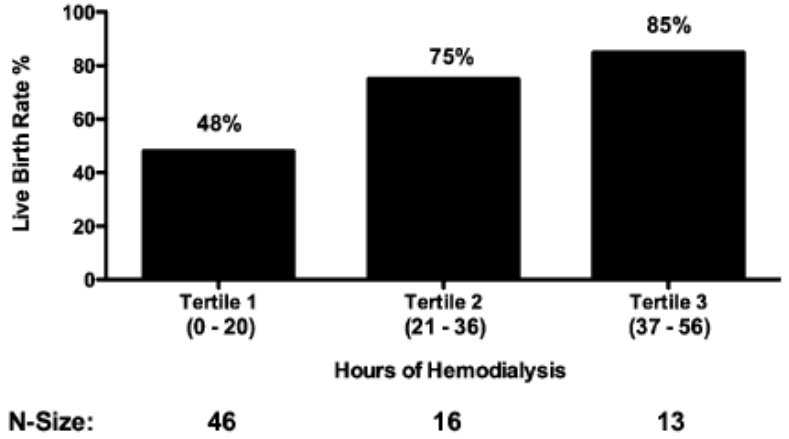


Figure 1. Live birth rates by dialysis intensity. In women with established ESRD, there is a significant dose-response relationship between hemodialysis intensity and the live birth rate (P=0.02), improving from 48% in women receiving ≤20 hours to 75% in women receiving between 21 and 36 hours to 85% in women receiving ≥37 hours of hemodialysis weekly.

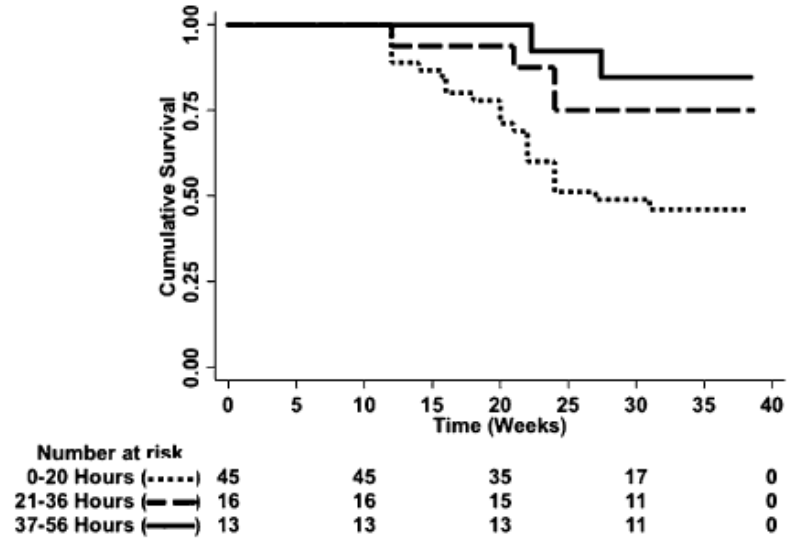
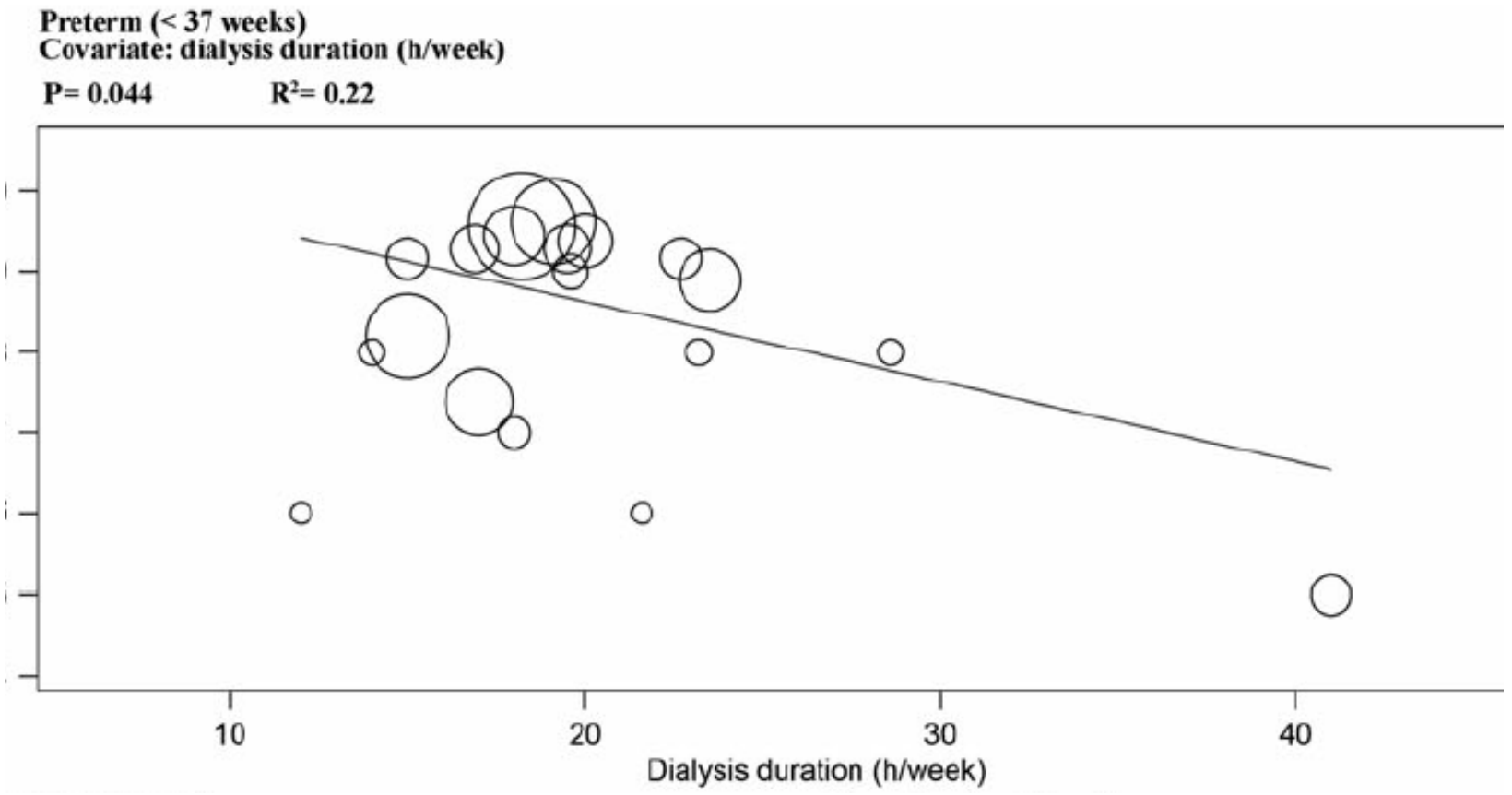


Figure 2. Time-to-event analysis by dialysis intensity. In women with established ESRD, there is a significant pregnancy survival advantage among women with high delivered doses of dialysis (log-rank test; P=0.01).

Hladunawich, JASN 2014

HOURS OF DIALYSIS AND PRETERM BIRTH



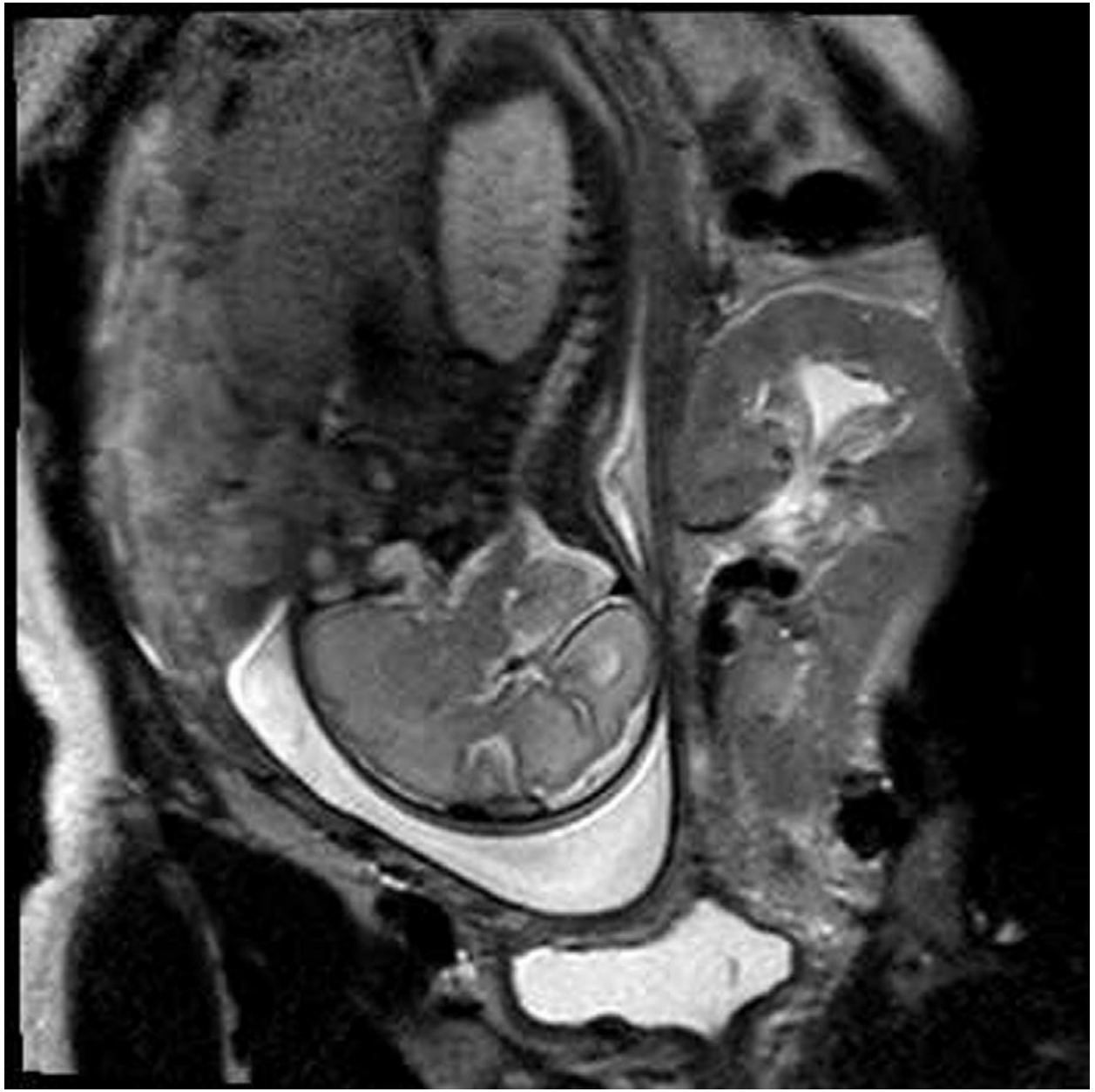
Picollo et al, NDT 2015

Table 6. Management of pregnant women on intensive hemodialysis

Maternal Management	Fetal Surveillance
Preconception and first trimester	
Medication review to stop and replace teratogenic medications (*e.g.*, ACEIs, ARBs, and statins)	Cautious interpretation of first trimester screen to exclude Down syndrome (increased β-hCG and PAPP-A)
Double doses of water-soluble vitamins with increased folic acid supplementation (5 mg/d)	False-positive screens should be confirmed by careful US measurement of nuchal translucency, amniocentesis, or the Harmony Test (cellfree DNA in maternal blood)
Daily protein intake of 1.5–1.8 g/kg per day	
Low-dose aspirin for preeclampsia prevention may be appropriate in some women but is of unclear benefit	
Intensification of HD dose to ≥36 h/wk in women without residual renal function; women with residual renal function can have dialysis dose tailored to metabolic parameters	
Increase dialysate bath potassium concentration (3 mEq/L)	
Increase dialysate bath calcium concentration (1.5 mmol/L or 6 mg/dl)	
Liberalize dietary phosphate, with possible dialysate bath sodium phosphate supplementation	
Increase the dose of ESAs to approximate the physiologic anemia of pregnancy (10–11 g/L)	
Use of weekly maintenance or bolus therapy of iv iron therapy to maintain normal iron saturation	
Heparin to maintain circuit patency	
Second and third trimesters, including delivery	
Frequent volume assessments to avoid hypotension and manage ultrafiltration	Maternal serum screen (AFP, inhibin A, total hCG, and unconjugated estriol) between 15 and 18 wk
Target BP <140/90 mmHg postdialysis	Level 2 US to measure cervical length and assess for anomalies at 18–20 wk
Preeclampsia surveillance after 20 wk (consider admission for fetal/maternal monitoring for sudden increases of BP, *etc.*)	Placental US with Doppler assessment at 22 wk
Weekly platelets and liver function tests to assess for preeclampsia from 26 wk until delivery	Weekly US and BPP from 26 wk until delivery
	Planned induction after 37 wk where appropriate
Postpartum care	
Medication review to ensure that all medications are compatible with breastfeeding	Neonatal assessment and care
Avoid volume depletion to facilitate breastfeeding	Preservative-free heparin to avoid neonatal toxicity by benzyl alcohol
Maternal emotional support	

ACEI, angiotensin–converting enzyme inhibitor; ARB, angiotensin II receptor antagonist; β-hCG, β–human chorionic gonadotropin; PAPP-A, pregnancy–associated plasma protein-A; US, ultrasound; HD, hemodialysis; AFP, α-fetoprotein; hCG, human chorionic gonadotropin; BPP, biophysical profile.

NephSAP,May 2016



TRANSPLANTATION

Risk of renal transplant on pregnancy and risk of pregnancy on graft survival

(Immunosuppressive therapy)

Antihypertensive therapy (as in non-transplant CKD)

Hereditary risk (CKD)

Stable transplant function

2 y after transplantation (guidelines differ)

6 m after stop of cellcept (stable graft function)(minimum 6 w)

WILL MY BABY BE BORN EARLY OR SMALL?

	UKOSS 2013 (n=104)	UK TPR (n=193)	PARTOUT NETWORK (n = 279)
Mean gestation	36 weeks	36 weeks	37 weeks
Birth Weight	2.5 kg	2.5 kg	2.5 kg
Prematurity (< 37 weeks)	52%	55%	47%
Low birth weight (< 2.5 kg)	48%	54%	43%
Very low birth weight (< 1.5 kg)	9%		14%
Intra-uterine growth restriction	24%	25%	18%

WILL PREGNANCY INFLUENCE GRAFT LOSS?

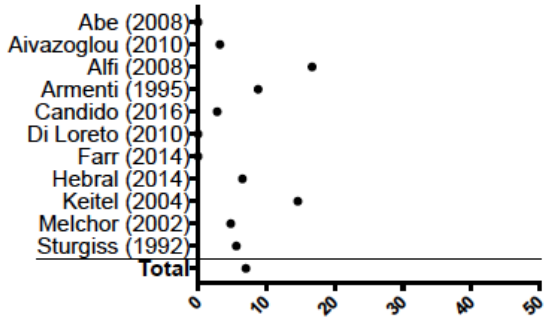


Figure 2a

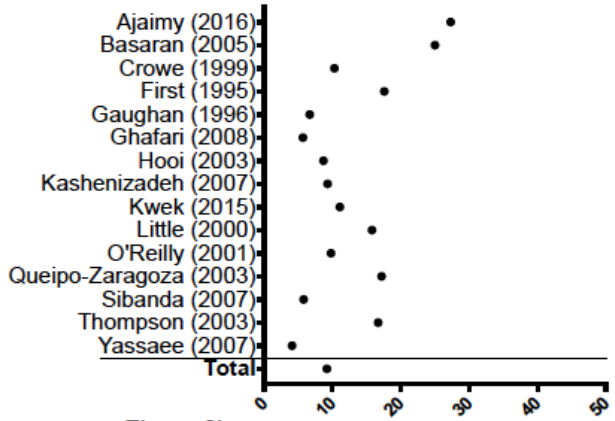


Figure 2b

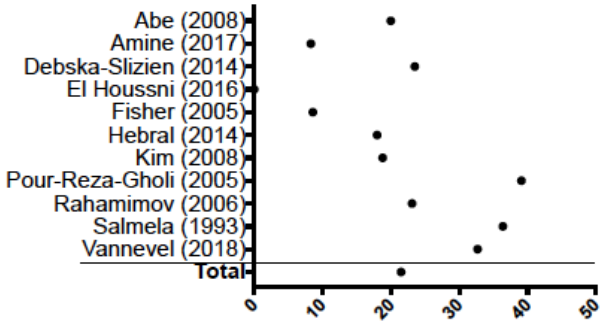


Figure 2c

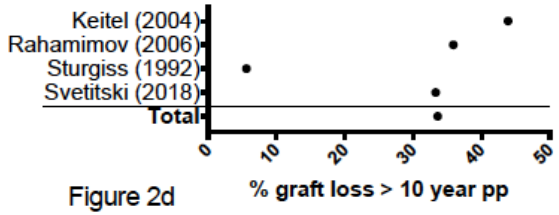


Figure 2d

Figure 2a-d: Pooled incidence of post-pregnancy graft loss
2A. Graft loss within two year post-pregnancy: 7.0%, n=384 (range 10-137), total graft loss n=27 (range 0-12)
2B. Graft loss two to five years post-pregnancy: 9.2%, n=600 (range 8-139), total graft loss n=55 (range 1-8)
2C. Graft loss five to ten years post-pregnancy: 21.5%, n=410 (range 12-81), total graft loss n=88 (range 0-18)
2D. Graft loss more than ten year post-pregnancy: 33.6%, n=116 (range 18-41), total graft loss n=39 (range 1-18)

Schellekens et al., in press, Transplantation

GRAFT SURVIVAL – CASE CONTROL

	N		Reference point	Matched for	Median FU time (months) after pregnancy	Graft Loss (%)		P
	Index	Control				Index	Control	
First (1995) USA	18	26 f 23 m	TCI	1,2,4,6,7	82.8 (43.2 – 164.4)	16,7	15,4 8,7	NS
Sturgiss (1995) UK	18	18	NR	5, 6	144 (48-276)	5,6	11,1	NS
Fischer (2005) Germany	81	81	TDI	1 - 4, 9,13	91.3 ± 5	8,6	4,9	NS
Pour-Reza Gholi (2005) Iran	60	60	NR	1, 2, 9	100.8 ± 48.5	39,1	28,3	NS
Rahamimov (2006) Israel	39	117	TCI	1, 2, 6-12	168 (72-264)	35,9	31,6	NS
Kashanizadeh (2007) Iran	86	125	NR	1,6,7,9,11	45 ± 22	9,3	7,2	NS
Kim (2008) Korea	48	187	NR	1,2,9	114 (44.4 – 184.8)	18,8	21,4	0,688
Stoumpos (2016) UK	89	83	TCI	1,4,5	98.8 (45.6 – 202.8)§	15,7	NR?	NS

§ IQR, N number of participants, FU follow-up, KT kidney transplantation, ESRD (End-Stage-Renal-Disease), IS medicine Immunosuppressive Medicine, HLA MM (Human Leucocyte Antigen Mismatch), PRA (Panel Reactive Antibody), NR (not reported), TDI Transplant to delivery interval, TCI Transplant to conception interval.

1. Age at KT, 2. Year of KT, 3. KT center, 4. Pre-conc Serum Creatinine, 5. Serum Creatinine, 6. Cause of End Stage Renal Disease, 7. Source of KT, 8. Etnicity,
2. 9. Immunosuppressive medication, 10. Donor Age, 11. HLA Mismatch/Panel reactive antibody%, 12. Number of KT, 13. Diabetes Mellitus

Schellekens et al., in press, Transplantation

WILL MY RENAL FUNCTION DETERIORATE AFTER PREGNANCY?

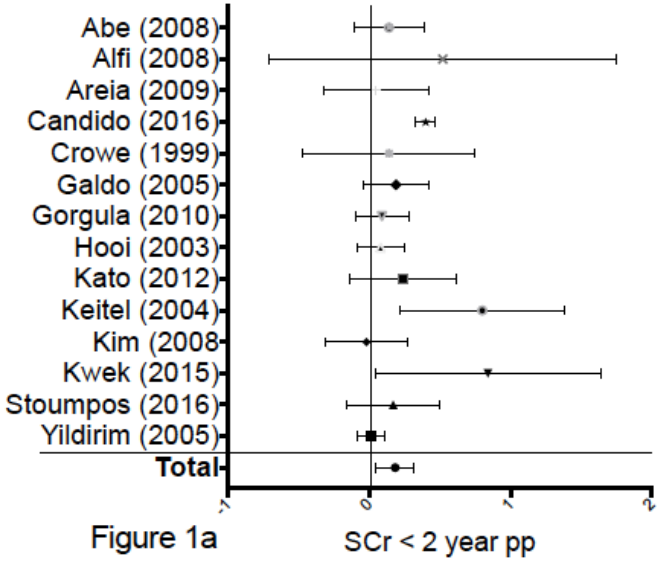


Figure 1a

SCr < 2 year pp

SCr 0.18 mg/dL [0.05, 0.32], p=0.007, n=441

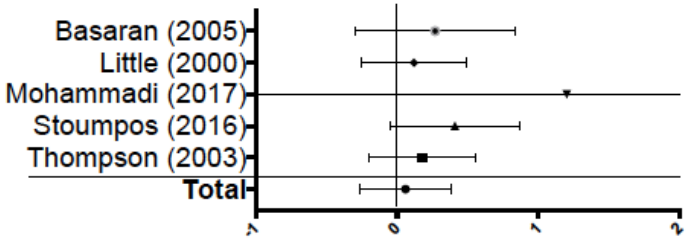


Figure 1b

SCr 2-5 year pp

SCr 0.17 mg/dL [-0.03, 0.37], p=0.09, n=175

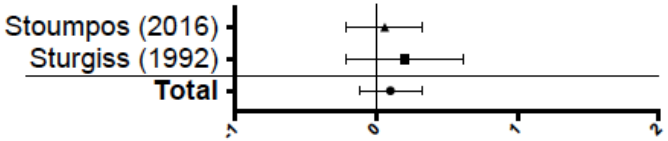


Figure 1c

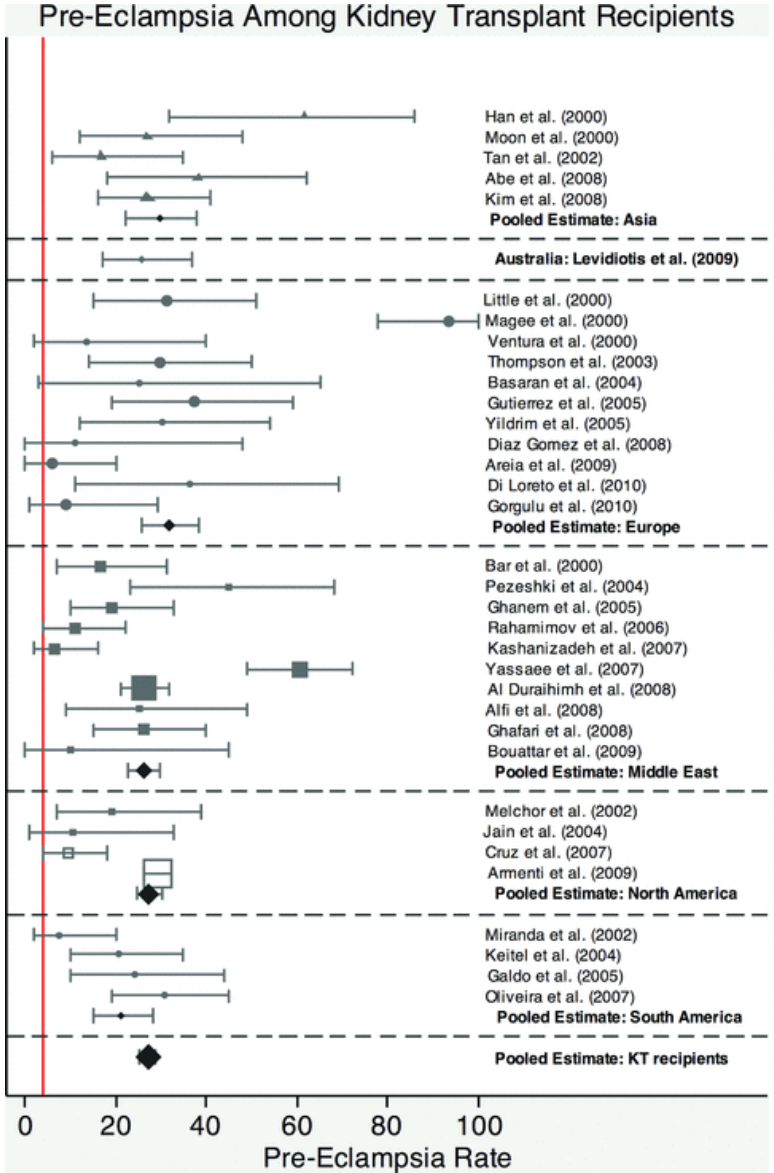
SCr 5-10 year pp

SCr 0.10 mg/dL [-0.12, 0.32], p=0.38, n=101

Figure 1a-c. Pooled difference (mean difference [95% CI] in pre-pregnancy SCr and post-pregnancy SCR (delta SCr pre- and post-pregnancy).

Schellekens et al., in press, Transplantation

PREECLAMPSIA RISK IN RENAL TRANSPLANT RECIPIENTS



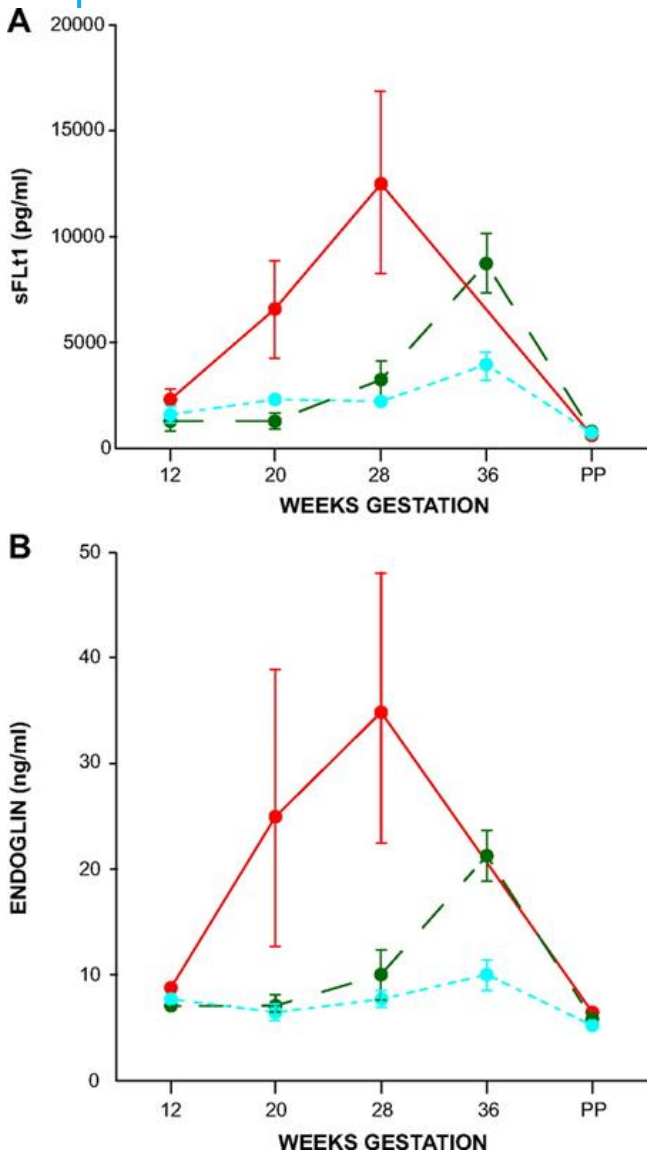
Deshpande, Am J Transplant. 2011 Nov;11(11):2388-404

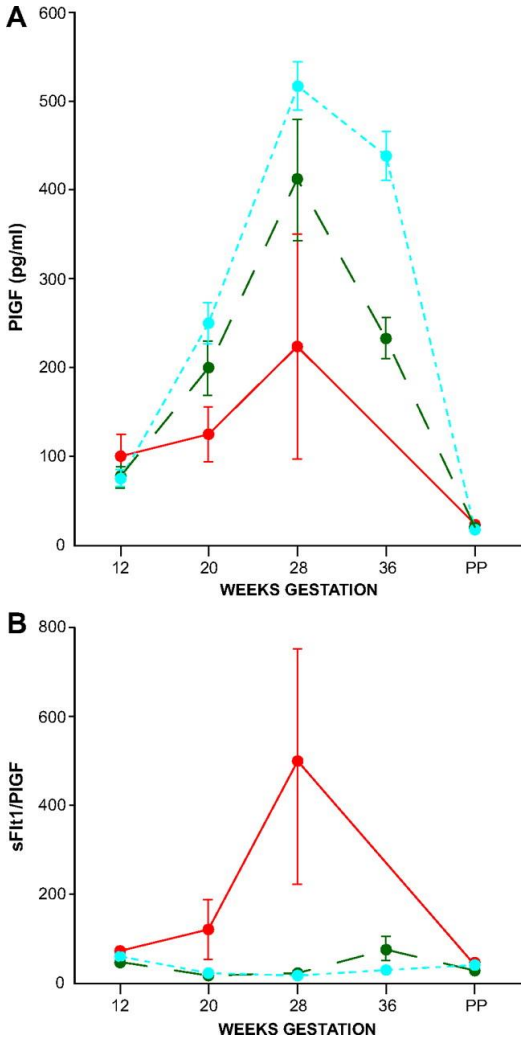
Aspirin 75-80 mg for all (8-36 weeks)

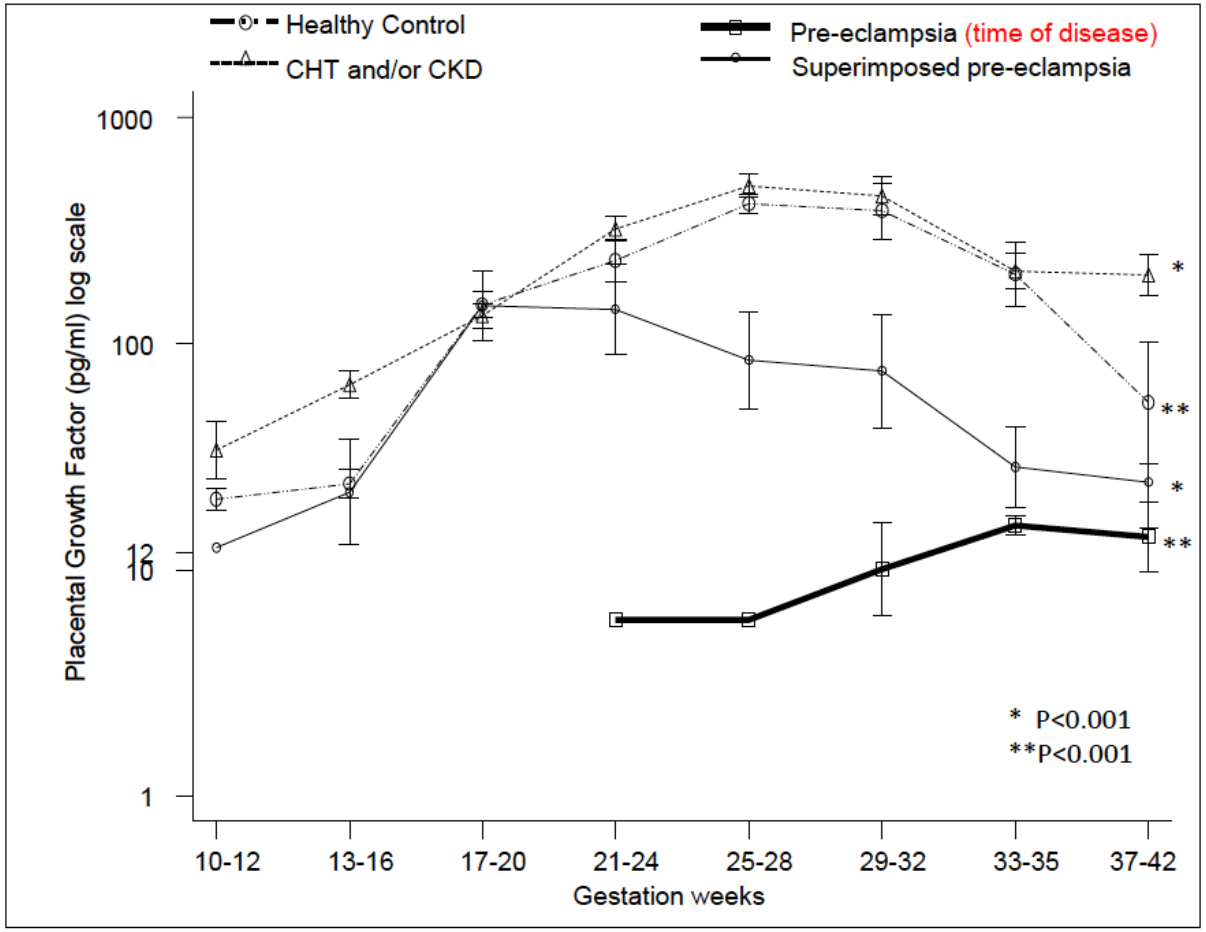
Risk level		
High risk	History of preeclampsia, especially when accompanied by an adverse outcome Multifetal gestation Chronic hypertension Type 1 or 2 diabetes Renal disease Autoimmune disease (systemic lupus erythematous, antiphospholipid syndrome)	Recommend low-dose aspirin if ≥ 1 risk factors
Moderate risk	Nulliparity Obesity (body mass index >30 kg/m^2) Family history of preeclampsia (mother or sister) Sociodemographic characteristics (African American race, low socioeconomic status) Age ≥35 years Personal history factors (e.g., low birthweight or small for gestational age, previous adverse pregnancy outcome, >10-year pregnancy interval)	Consider low-dose aspirin if the patient has several of these moderate-risk factors
Low risk	Previous uncomplicated full-term delivery	Do not recommend low-dose aspirin

Low-Dose Aspirin Use for the Prevention of Morbidity and Mortality From Preeclampsia, U.S. Preventive Services Task Force Recommendation Statement Release Date: September 9, 2014

ANGIOGENIC FACTORS

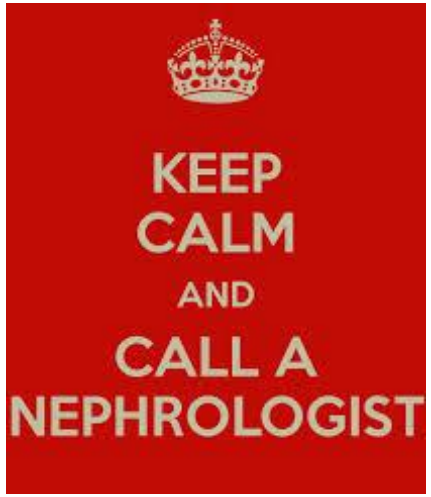






Perni U et al. Hypertension. 2012;59:740-746, Brahmham Kidney International 2016

MULTIDISCIPLINARY APPROACH



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THE END

ERKNet
The European Rare Kidney Disease Reference Network

NEXT WEBINAR:

Enrico Vidal (Udine, Italy)

Non-infectious complications of Peritoneal Dialysis in Children

TUESDAY September 24, 2019 at 4:00-5:00 pm CET